

**TRENHOLM STATE (AL) TECHNICAL COLLEGE**  
**HIGH SCHOOL SCIENCE ENRICHMENT PROGRAM**  
**1996-'97 EVALUATION REPORT**

Submitted to:  
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## **EXECUTIVE SUMMARY**

This document presents findings based on a third-year evaluation of Trenholm State (AL) Technical College's National Aeronautics and Space Administration (NASA) - supported High School Science Enrichment Program (HSSEP). HSSEP is an external (to school) program for area students from groups that are underrepresented in the mathematics, science, engineering and technology (MSET) professions. In addition to gaining insight into scientific careers, HSSEP participants learn about and deliver presentations that focus on mathematics applications, scientific problem-solving and computer programming during a seven-week summer or 10-week Academic-Year Saturday session.

The purpose of this follow-up evaluation report is three-fold:

- 1) to determine whether HSSEP has been able to sustain and improve upon its initial success, despite increased enrollment and the inclusion of more students from at-risk groups (e.g., boys, rural students);
- 2) to determine whether second-year improvements in participants' math/science; classroom performance continues; and
- 3) to determine whether there are any correlates of success that can be used to help HSSEP increase the diversity in its student population while continuing to produce positive participant outcomes .

Using content analyses of existing program documents and student records; on-site observations and interviews; and surveys that provide implementation assessment and self-reported outcome data, the author found that:

HSSEP has been able to:

- serve increased numbers of students without benefit of additional funding;
- increase the percentage of students in each cohort who are 9<sup>th</sup> graders; and
- significantly increase the participation of boys over the last two years.

Educational services were rated "Very Effective" by at least half – and as many as 88 percent of the participants. Moreover, with the exception of field trips, all of the Program services were perceived as being more effectively delivered than in 1995-'96.

HSSEP's frequent student/parent/staff interactions and its emphasis on rigorous participation requirements, parental involvement in decision-making and continuous implementation improvement have increased attendance and retention. The significantly higher retention of freshmen (versus sophomores) lends additional support to the Program's decision to shift its recruiting focus to ninth graders. Student interviewees indicate that earlier participation:

- helps them avoid the initial failure that caused siblings/peers to drop out of the math/science pipeline;
- unlearn previously learned errors;
- develop the practice of working in groups; and
- gain opportunities to earn money as tutors -- while reinforcing skills that they might otherwise have forgotten.

**HSSEP continues to make a significant, positive difference in the perceived MSET educational outcomes of its participants.** At least half of all respondents **strongly agree** that HSSEP had a positive impact on their MSET outcomes.

Given concerns about the extent to which HSSEP experiences are translated into improved classroom performance, input from participants' classroom teachers was elicited for the first time. Teachers' overall ratings were very similar to students self-assessments. While 51 percent of students indicated that their math, science and computing was "very much" improved, 45 percent of the students rated by classroom teachers received a comparable rating.

Among the improvements most frequently cited in teachers' essay responses were:

- Greater interest/motivation;
- More confidence;
- More focus and seriousness in approaching work; and
- Better preparation and attention to homework

Participant improvement was less evident when other outcome measures are considered.

HSSEP students' ACT mathematics scores continued to reflect the substantial or statistically significant pre-post improvement noted in the 1995-'96 Evaluation Report. In contrast, last year's gains in the science area were not replicated.

Previously expressed concerns (see First Annual Report) about concept mastery and educational standards surfaced again when analyses of math/science GPAs for 1996-97 participants revealed substantially weaker performance in both math and science. Not only did the establishment of closer relationships with local school districts and efforts to achieve more compatibility between HSSEP and classroom curricula fail to sustain the improvement noted last year, but the performance of students with sustained participation in HSSEP also declined.

Follow-up interviews and secondary analyses of project documentation and student performance data suggest that participants' classroom performance is, in part, due to the inclusion of more "at-risk" students, policies that permit participation based on interest rather than performance and less-than-desired parental participation. For example,

- As a result of more aggressive outreach, the number of boys recruited by HSSEP increased significantly. Given their poorer classroom performance, boys contributed to the overall decline in HSSEP students' math/ science GPAs;
- Students' who were retained despite ACT pre-post scores that did not improve, were more likely to be poor classroom performers (i.e., those with math/science GPAs below 2.5);
- Among Persisters, those with the highest percentage of possible sessions attended were better performers in the classroom; and
- Those whose parents were actively involved in HSSEP were more likely to perform well in the classroom.

Post-high school outcomes for the 1997 HSSEP class are positive, but not quite as good as in the past two years. Although there was a 100 percent graduation rate among HSSEP students, enrollment in college MSET majors was only 50 percent versus 65 percent in 1995 and 78 percent for the 1996 graduates.

As noted in the January 1996 HSSEP Evaluation Report, HSSEP alumni's post-high school outcomes are in stark contrast to those of their Montgomery County counterparts. Countywide, only 6.5 percent of African-Americans completed special academic programs in science and engineering and only 9 percent planned to pursue careers in engineering, mathematics or science.

Based on findings presented herein, the Evaluator recommends that:

- 1) In light of the increased emphasis on recruiting boys, HSSEP should make provisions for identifying the unique needs, learning influences and preferences that may need to be considered in order to successfully intervene on behalf of a population that is extremely "at-risk" in the Montgomery/Lowndes County area;
- 2) The study skills/test-taking course receive special attention in next year's evaluation, so as to determine the reason why classroom teachers continue to cite students' shortcomings in this area;
- 3) HSSEP consider meeting its reading, writing and speaking improvement objectives by integrating communications activities into MSET classes. This will allow the Program to use time currently devoted to the Communications Component for additional MSET intervention;
- 4) HSSEP use measures of Program and classroom performance to determine eligibility for continued Program participation, receipt of stipend and other incentives that might address what may be diminished motivation among students (e.g., 3-4 sessions attended) who are neither new to the Program or seriously committed to preparing for an MSET career; and
- 5) Strategies be developed to increase the level of participation among parents. As a first step, the results of this Report should be shared with parents in a "town meeting" format that gives them an opportunity to develop a sense of ownership of the program and empowerment, in terms of influencing their children's educational outcomes.

## **OVERVIEW**

### **PROGRAM RATIONALE AND HISTORY**

This document presents findings based on a third-year evaluation of Trenholm State (AL) Technical College's National Aeronautics and Space Administration (NASA) - supported High School Science Enrichment Program (HSSEP). HSSEP is an external (to school) program that provides math, science, computer science and communications enrichment for high school students who reside in Montgomery or Lowndes County (AL). HSSEP's proposal called for the Program to serve 40-50 students from groups that are underrepresented in the mathematics, science, engineering and technology (MSET) professions. HSSEP Participants have diverse academic achievement histories, but share an expressed interest in mathematics and science, a willingness to regularly attend a seven-week summer or 10-week Saturday session during the academic year.

Previous HSSEP evaluation reports contain detailed information regarding the curriculum, whose components include:

**Mathematics Applications.--** Students use graphing calculators and a variety of software packages in math and statistics to enhance their understanding of concepts taught in the Integrated Science course and prepare them to improve their performance on standardized aptitude and achievement tests.

**Integrated Science.--** Students are introduced to the scientific method and the integration of problem-solving skills in science through the use of hands-on laboratory experiments, demonstrations, audio visuals and group projects.

**Computer Literacy and Programming.--** Students learn the basic terminology of computers, computer operations, programming using BASIC and Turbo PASCAL, and spreadsheet, data base and word processing software applications.

**Communications.--** Students prepare and deliver presentations on topics in applied math and science to enrich reading, writing, comprehension, listening and speaking skills.

**Field Experiences in Science.--** Activities include field trips and seminars, career interest inventory completion and analysis; presentations from role models; and career games.

HSSEP's previous evaluation reports indicate that after some initial start-up difficulties, HSSEP was being fully and effectively implemented. Interim measures (e.g., participants' enrollment in challenging math/science courses, attendance/persistence rates, indications of increased interest in math/science) and post-high school outcomes (e.g., college enrollment, choice of MSET major) for initial HSSEP graduates suggest that HSSEP was making progress in its efforts to provide access to MSET careers for historically by-passed students.

### **EVALUATION RATIONALE**

The purpose of this follow-up evaluation report is three-fold:

- 1) to determine whether HSSEP has been able to sustain and improve upon its initial success, despite increased enrollment and the inclusion of more students from at-risk groups (e.g., boys, rural students);

- 2) to determine whether second-year improvements in participants' math/science; classroom performance continues; and
- 3) to determine whether there are any correlates of success that can be used to help HSSEP increase the diversity in its student population while continuing to produce positive participant outcomes .

### **METHODOLOGY**

Data produced by the HSSEP information system and evaluation design are derived from:

- content analyses of existing program documents (e.g., previously submitted evaluation reports, participation records);
- on-site observations and interviews with Trenholm administrators, HSSEP administrators, faculty and students;
- participant surveys that provide implementation assessment and self-reported outcome data;
- Surveys assessing student performance and indicating areas needing intervention that were completed by participants' classroom teachers
- analyses of students' transcripts; and
- Participants' scores on pre-post administrations of parallel forms of the American College Test mathematics and science practice examinations.

Descriptive and comparative analyses of the above-referenced data provide the basis for the findings and discussion presented in the next section

## **FINDINGS AND DISCUSSION**

### **PROGRAM IMPLEMENTATION**

#### **Recruitment**

HSSEP's annual enrollment goal is 40-50 students from groups underrepresented in mathematics, science, engineering and technology professions (MSET). In addition, earlier evaluations suggested two other recruiting goals: (1) increased representation of 9<sup>th</sup> graders who have more time (prior to graduating) in which to benefit from educational intervention; and (2) increased participation by boys whose high school performance and college enrollment consistently lag behind those of girls in Montgomery and Lowndes County. The data in Table 1 indicate that HSSEP is achieving all of its recruiting goals. Specifically, HSSEP has been able to:

- serve increased numbers of students without benefit of additional funding;
- increase the percentage of students in each cohort who are 9<sup>th</sup> graders; and
- significantly increase the participation of boys over the last two years.

**TABLE 1**

**The Distribution of HSSEP Students By Cohort, Gender and Grade**

<u>Cohort</u>	<u># New Admits</u>	<u>Male</u>	<u>Female</u>	<u>9</u>	<u>New Admit Grade Level</u>			<u># Returnees</u>	<u>Total</u>
					<u>10</u>	<u>11</u>	<u>12</u>		
1994-'95	65	21	44	13	25	8	19	N/A	65
1995-'96	49	8	41	21	20	8	0	25	74
1996-'97	47	21	26	34	13	0	0	35	82
1997-'98 Summer Only	15	8	7	15	0	0	0	43	58

#### **Providing Educational Intervention Services**

Participating students' survey responses indicate that HSSEP was fully implemented. Nearly all respondents indicated that they were exposed to each of the Program components described in HSSEP's original proposal or subsequent modifications of that technical approach. In addition to being fully implemented, comparisons of ratings by 1995-'96 and 1996-'97 participants suggest that the delivery of HSSEP services is improving as the staff and its director gain experience and modify the approach to meet emerging needs and concerns.

The data presented in Table 2 summarize students' perceptions of the quality of services they received. Those data reveal that all of the educational services were rated "Very Effective" by at least half – and as many as 88 percent of the participants. Moreover, with the exception of field trips, all of the Program services were perceived as being more effectively delivered than in 1995-'96.

**TABLE 2**

**Percentage of Students Rating HSSEP Service Delivery "Very Effective"**

<b>SERVICE</b>	<b>1995-'96</b>	<b>1996-'97</b>
Orientation clearly spelled out expectations	70	83
Faculty took the time to answer questions	78	88
Laboratory and classroom facilities	51	70
Field trips provided good career information	71	67
Activities showing parents how to be more supportive	41	66
Minority role models provided E&S career insights	55	60
Staff were available to discuss my concerns	50	57
Teacher preparation and knowledge	61	79
Strategies for involving all students	53	54
Provided adequate individual attention	54	65
Provided competent Teaching Assistants	58	84
Allowed sufficient time to complete course requirements	20	49

**The Focus of Future Interventions**

HSSEP participants' classroom teachers were asked to indicate areas in which these students needed additional intervention. The most frequent suggestions and the percentage of responses citing the need were:

- Tutoring in specific subjects (19%)
- Test-taking skills (17%)
- Study skills (14%)

Depending on the classroom performance of HSSEP participants, Program administrators may wish to consider modifying the intervention to incorporate or increase the time devoted to the above teacher recommendations.



## **PROGRAM OUTCOMES**

### **Attendance and Retention of Students in the MSET Pipeline**

Attrition in educational enrichment programs often becomes a problem at the high school level. Student participation declines either because the program has ceased to meet their needs or because other commitments take precedence. In contrast, data suggest that HSSEP's frequent student/parent/staff interactions and its emphasis on rigorous participation requirements, parental involvement in decision-making and continuous implementation improvement have increased student participation. Attendance continues to be in the mid-nineties with very few students dropping out during any given session. In addition, Table 3 indicates that the percentage of HSSEP students who forego other interests to return for additional MSET enrichment continues to grow.

**TABLE 3**

#### **Program Persistence Rate by Grade**

<u>Cohort</u>	<u>9<sup>th</sup> Grade Admits</u>	<u>10<sup>th</sup> Grade Admits</u>
1994-95	38.5	15.4
1995-96	68.4	18.2
1996-97	72.7	37.9

The increasing number of HSSEP students remaining in the MSET pipeline is consistent with the perceived benefits (among students) of Program participation reported in the previous section. The statistically significant ( $p < .01$ ) differences in the persistence of those who enter HSSEP as freshmen (versus sophomores) lends additional support to the Program's decision to shift its recruiting focus to ninth graders. As reported previously, student interviewees indicate that earlier participation:

- helps them avoid the initial failure that caused siblings/peers to drop out of the math/science pipeline;
- unlearn previously learned errors;
- develop the practice of working in groups; and
- gain opportunities to earn money as tutors -- while reinforcing skills that they might otherwise have forgotten.

### **Indications of HSSEP's Positive Participant Impact**

There are numerous measures by which one can assess the extent to which HSSEP is helping participants achieve the Program's objectives of increased math/science interest and proficiency. Analyses of these measures (e.g., participant self-reports; ACT pretest-posttest scores) reveal that **HSSEP continues to make a significant, positive difference in the MSET educational outcomes of its participants**. Unlike last year however, there are some indications that additional modifications are needed to meet the needs of a changing HSSEP participant population.

### **Participants' Personal Assessments**

Students' survey responses reveal their belief that HSSEP is not only effectively implemented, but also plays a major role in increasing their math/science/technology interest and learning. Table 4 indicates that at least half of all respondents **strongly agree** that HSSEP had a positive impact on their MSET outcomes. Comparisons of 1995-'96 and 1996-'97 participant assessments indicate that the communications component was somewhat more successful in improving students' writing and speaking skills. On the other hand, while there are some small year-to-year fluctuations in the Program's effect on participants' MSET skills, the overall picture remains largely unchanged.

**TABLE 4**

#### **Percentage of Students Who Strongly Agree With Statements Concerning HSSEP's Positive Impact on Their MSET Interest and Learning**

Student Outcome	1995-96	1996-97
HSSEP increased my confidence that I can do well in school	65	60
I would like to continue participating in HSSEP	59	63
I learned a lot about science	61	63
I learned a lot about mathematics	43	44
I learned a lot about computer programming	46	51
I became more interested in computer programming	63	59
I became more interested in science	50	49
I became more interested in math	31	37
My writing skills improved	39	47
My reading skills improved	44	42
My public speaking skills improved	42	55

Given the weak performance of Alabama's African-American students on the National Assessment of Educational Progress' (NAEP) 8<sup>th</sup> Grade Mathematics Test, HSSEP should consider examining why its positive impact is least pronounced in the mathematics area. Administrators may also want to consider whether, in light of HSSEP's modest communications success, students might benefit from greater exposure to MSET experiences.

### **Classroom Teachers' Assessments of HSSEP Students' MSET Progress**

Given concerns about the extent to which HSSEP experiences are translated into improved classroom performance, input from participants' classroom teachers was elicited for the first time. Teachers' overall ratings were very similar to students self-assessments. While 51 percent of students indicated that their math, science and computing was "very much" improved, 45 percent of the students rated by classroom teachers received a comparable rating (see Table 5).

**TABLE 5**

### **Classroom Teachers' Assessments of HSSEP Students' MSET Improvement**

<u>Category</u>	<u>Percent of Students</u>
Sustained/Enhanced Excellence	08
Great Improvement	37
Some Improvement	39
The Same/Diminished Performance	16

Among the improvements most frequently cited in teachers' essay responses were:

- Greater interest/motivation;
- More confidence;
- More focus and seriousness in approaching work; and
- Better preparation and attention to homework

### **ACT Test Score Improvement**

Beginning in the 1996 summer session, parallel forms of a practice ACT exam were administered on a pre-test post-test basis. Score changes measured how much students learned in a preparation course that offered: test-taking tips; sample problems; cognitive skill development exercises; insight into the psychometric principles underlying test construction; and other activities with demonstrated effectiveness in raising students' aptitude test scores.

HSSEP students' ACT mathematics scores continued to reflect the substantial or statistically significant pre-post improvement noted in the 1995-'96 Evaluation Report. In contrast, last year's gains in the science area were not replicated (see Table 6).

**TABLE 6**

**Mean ACT Pre and Post-Test Math/Science Scores (By Grade and Year)**

	<u>Grade</u>							
	<u>9</u>		<u>10</u>		<u>11</u>		<u>12</u>	
	<u>1995-96</u>	<u>96-97</u>	<u>95-96</u>	<u>96-97</u>	<u>95-96</u>	<u>96-97</u>	<u>95-96</u>	<u>96-97</u>
Math Pre-Test	11.0	11.2	13.9	13.1	10.7	12.6	11.5	8.0
Math Post-Test	14.4	15.5	17.7	16.9	15.4	14.8	15.0	13.3
Science Pre-Test	18.7	17.5	15.4	16.3	17.6	16.3	16.0	22.8
Science Post-Test	17.2	15.6	18.3	16.9	20.0	16.6	24.8	23.8

Because the critical mass of HSSEP students has yet to have the ACT administered for college admission purposes, it is still too early to determine the impact of test preparation activities on scores that are meaningful. In fact, the Director has speculated that test performance is negatively impacted by multiple administrations to students participating in HSSEP for a second year. While the reasons for the (relatively) poorer pre-post performance are unclear, the relationship between pre-post test differences and student performance will be explored in a subsequent section.

**Math/Science Grades**

The January 1996 Evaluation Report noted that many HSSEP students would be able to take calculus in high school -- because of taking math courses above their grade level in junior high school. While acknowledging the potential benefits of this trend, the Report raised a concern about students' lower-than-expected math/science grades. It was hypothesized that HSSEP students, in their haste to take advanced courses, might not be (1) meeting the performance standards against which they are graded; or (2) mastering concepts critical to their future math/science success.

The concern about concept mastery and educational standards surfaced again when analyses of math/science GPAs for 1996-97 participants revealed that substantially weaker performance in both math and science. Not only did the establishment of closer relationships with local school districts and efforts to achieve more compatibility between HSSEP and classroom curricula fail to sustain the improvement noted last year, but the performance of students with sustained participation in HSSEP also declined (see below)

GROUP	GPA
1994-'95 Persisters	2.87
1995-'96 Persisters	3.25
1996-'97 Persisters	2.75

In an effort to explain the sudden emergence of poor classroom performance, the relationship between previously cited program changes and math/science GPA were examined. While small sample sizes and other methodological considerations limit our ability to quantify and generalize, from analyses of the available data, the following relationships appear to account for some of the performance differences noted among HSSEP students:

- Because of their underrepresentation in previous HSSEP cohorts, the number of boys recruited by the Program increased significantly. Given their poorer classroom performance, boys contributed to the overall decline in HSSEP students' math/science GPAs;
- Students' whose ACT pre-post scores did not improve, were more likely to be poor classroom performers (i.e., those with math/science GPAs below 2.5);
- Among Persisters, those with the highest percentage of possible sessions attended were better performers in the classroom; and
- Those whose parents were actively involved in HSSEP were more likely to perform well in the classroom.

#### **1997 Graduates' Post-Program Outcomes**

Post-high school outcomes for the 1997 HSSEP class are positive, but not quite as good as in the past two years. Although there was a 100 percent graduation rate among HSSEP students, enrollment in college MSET majors was only 50 percent versus 65 percent in 1995 and 78 percent for the 1996 graduates. Given the small sample size fluctuations of this magnitude are not unexpected.

As noted in the January 1996 HSSEP Evaluation Report, HSSEP alumni's post-high school outcomes are in stark contrast to those of their Montgomery County counterparts. Countywide, only 6.5 percent of African-Americans completed special academic programs in science and engineering and only 9 percent planned to pursue careers in engineering, mathematics or science.

## RECOMMENDATIONS

Based on findings presented herein, the Evaluator recommends that:

- 1) In light of the increased emphasis on recruiting boys, HSSEP should make provisions for identifying the unique needs, learning influences and preferences that may need to be considered in order to successfully intervene on behalf of a population that is extremely "at-risk" in the Montgomery/Lowndes County area;
- 2) The study skills/test-taking course receive special attention in next year's evaluation, so as to determine the reason why classroom teachers continue to cite students' shortcomings in this area;
- 3) HSSEP consider meeting its reading, writing and speaking improvement objectives by integrating communications activities into MSET classes. This will allow the Program to use time currently devoted to the Communications Component for additional MSET intervention;
- 4) HSSEP use measures of Program and classroom performance to determine eligibility for continued Program participation, receipt of stipend and other incentives that might address what may be diminished motivation among students (e.g., 3-4 sessions attended) who are neither new to the Program or seriously committed to preparing for an MSET career; and
- 5) Strategies be developed to increase the level of participation among parents. As a first step, the results of this Report should be shared with parents in a "town meeting" format that gives them an opportunity to develop a sense of ownership of the program and empowerment, in terms of influencing their children's educational outcomes.